
CHAPTER IV J

Kesterson National Wildlife Refuge Alternative Plans



***U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
MID-PACIFIC REGION***

CHAPTER IV J

KESTERSON NATIONAL WILDLIFE REFUGE

Kesterson National Wildlife Refuge (Refuge) was purchased by Reclamation in 1969 as part of the San Luis Drain Project. Originally, the 5,900-acre refuge was to be used as a regulating reservoir for drain water. The Refuge consists of natural marshlands and grassland/vernal pool habitat. The Refuge is located four miles east of Gustine, as shown in Figure IV J-1.

As discussed in Chapter IV G, a portion of the refuge was contaminated due to high selenium concentrations. These areas are currently managed by Reclamation under the Kesterson Cleanup Program and are not discussed in this document. The Service manages the remainder of the Refuge.

The management objectives of the portion of the Refuge managed by the Service are to provide habitat for migratory waterfowl and shorebirds, and to maintain habitats and populations of endangered species, native plants, and animals. From October to April, the Refuge provides flooded wetlands for loafing, nesting, and feeding waterfowl. Flooded wetlands are available in closed areas to provide sanctuary for waterfowl and in hunting areas to provide hunting opportunities.

Management activities are directed at providing marsh food plants through moist soil management practices. Swamp timothy, smartweed, spikerush, and alkali bulrush are the major food-producing species. Production of these species require drawdown of the waters in the spring and irrigation during the summer (USBR, 1986a).

At full development, additional wetlands would be provided and food production would be less intensive with swamp timothy and alkali bulrush being the major species managed. This would provide a more open marsh. The eastern side of the Refuge would have some permanent water and thicker stands of cattail and bulrush to partially compensate for the loss of the contaminated Kesterson Reservoir and to provide nesting habitat for critical species such as the tri-colored blackbird. Periodic flushings would occur in the fall and winter to maintain acceptable salt balances.

A. WATER RESOURCES

The Refuge receives 3,500 acre-feet of firm CVP water each year through the Grassland Water District (GWD). Drain water is not used for refuge management due to unacceptable levels of selenium. As discussed in Chapter IV G of this report, water quality has been a problem at the Refuge.

1. Surface Waters

The GWD conveys water to the Refuge from September 15 to November 15 through the San Luis Canal Company (SLCC) San Luis Canal and the GWD Santa Fe Canal.

The San Luis Drain terminates in the central area of the Refuge at the GWD Mud Slough. Water from the San Luis Drain and the GWD Mud Slough is not used due to selenium contamination.

2. Water Conveyance Facilities

The GWD delivers water to the east side of the Refuge through the San Luis Canal and a deep well. The capacity of the SLCC San Luis Canal is limited to 20 cfs due to the size of control structures and shape of the canal. Cleaning and reshaping of the SLCC San Luis Canal, rehabilitation of levees, and improvements to drainage channels are needed to assure adequate water delivery capacities.

Water is delivered to the west side of the Refuge through the GWD Santa Fe Canal and Eagle Ditch. The GWD Santa Fe Canal is located near the southwestern end of the Refuge and drains into the GWD Mud Slough and the wetlands outside of the Refuge. The GWD Santa Fe Canal has adequate capacity to deliver water to the Refuge.

Eagle Ditch is located just outside the west-central side of the Refuge. The Eagle Ditch receives water from the GWD Santa Fe Canal. Water from the Eagle Ditch must be conveyed to the Refuge through private wetlands within Grassland Resource Conservation District (GRCD).

Conveyance system problems within the Refuge are due to the lack of facilities to supply water to the Refuge boundaries. For example, there is no adequate means of delivering water through Eagle Ditch to the northwest portion the Refuge.

3. Groundwater

Groundwater levels are generally within 25 feet of the land surfaces. The Refuge has similar geologic conditions as the GRCD described in Chapter IV G.

One well on the Refuge has been reactivated and provides water to a portion of the east side. The reactivated well produces 20,000 gpm. The well produces water with a fairly high salt content, therefore, surface water with a low salt level is added periodically for dilution. Reclamation estimates the safe yield to be 11,900 acre-feet per year.

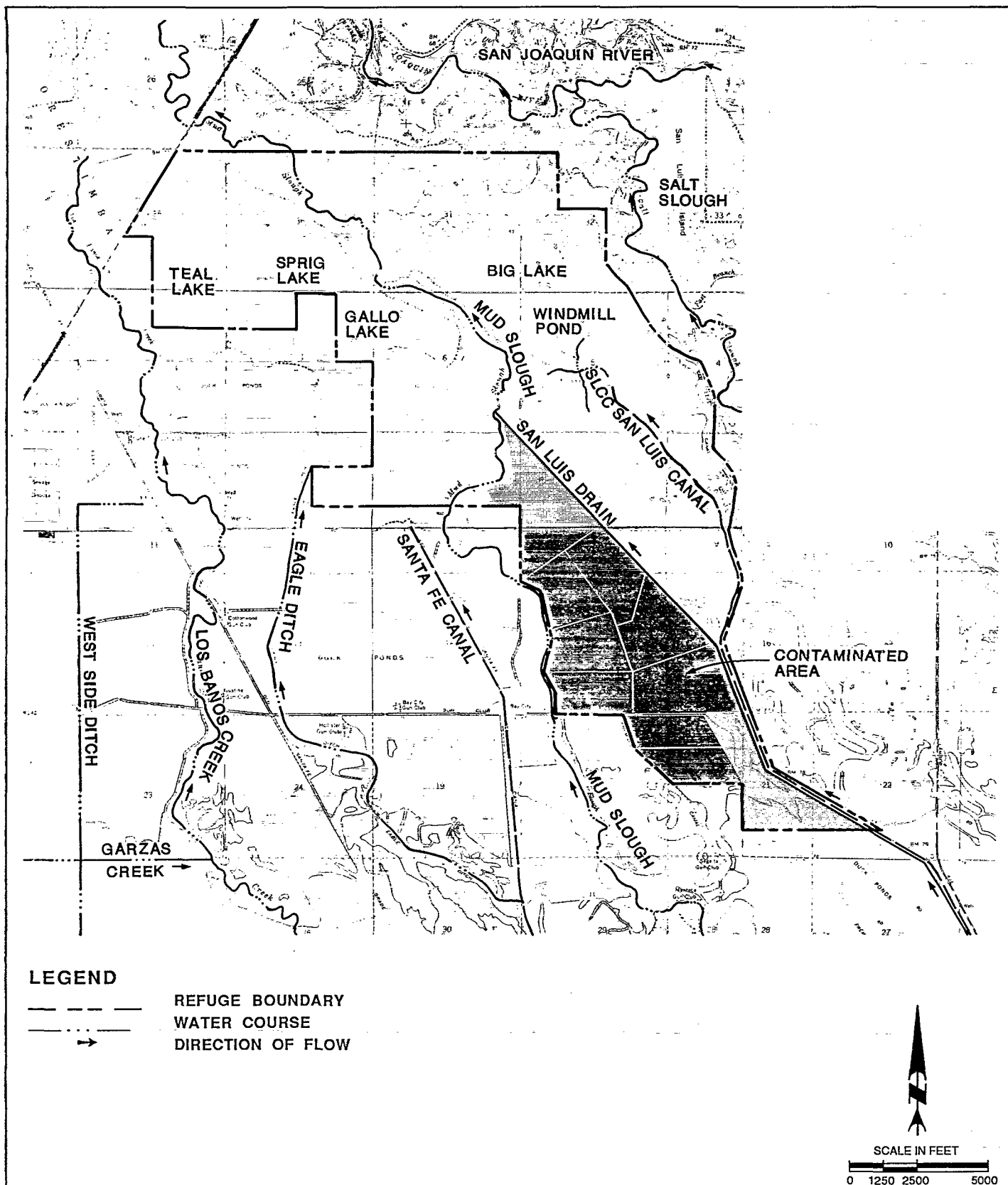


FIGURE IV J-1

KESTERSON NATIONAL WILDLIFE REFUGE

EXISTING WATER SUPPLY FACILITIES

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B. FORMULATION AND EVALUATION OF ALTERNATIVE PLANS

The Service estimates that 10,000 acre-feet of water would be required for full development and optimum management of the entire Refuge. For the purposes of assessing the impacts of water delivery alternatives, four levels of water supply have been identified, as are presented in Table IV J-1. Each of the water supply levels provides a different volume of water, and are summarized as follows:

Level 1 - Existing firm water supply

Level 2 - Current average annual water deliveries

Level 3 - Water supply needed for full use of existing development

Level 4 - Water delivery needed for optimum management

1. Delivery Alternative for Level 1 (No Action Alternative) (3,500 acre-feet)

No new facilities would be required to deliver the existing firm water supply. However to ensure that good quality water is provided to the Refuge through the SLCC San Luis Canal, the Zahm-Sansoni-Nelson Plan would need to be implemented. The Zahm-Sansoni-Nelson Plan was described under Alternative 2A for the Grassland Resource Conservation District in Chapter IV G.

2. Delivery Alternative for Level 2 (3,500 acre-feet)

Alternative 2A would increase water delivery efficiency on the Refuge. This alternative would require implementation of the Zahm-Sansoni-Nelson Plan to provide good quality water to the Refuge.

Alternative 2A - Rehabilitate Santa Fe Canal. To maximize water delivery efficiency, the existing terminals of the GWD Santa Fe Canal would be rehabilitated and extended, and a weir would be replaced or rehabilitated, as shown in Figure IV J-2.

3. Delivery Alternatives for Level 3 (10,000 acre-feet)

Alternatives 3A, 3B, 3C, and 3D would increase the water supplies available to developed areas of the Refuge. Alternative 3E would provide a conjunctive use program. All of these alternatives would require implementation of the Zahm-Sansoni-Nelson Plan and Alternative 2A.

Alternative 3A - Extend Eagle Ditch into the Refuge. Eagle Ditch would be extended northward through the Lone Tree Duck Club to Teal

TABLE IV J-1
DEPENDABLE WATER SUPPLY NEEDS
ALTERNATIVE SUPPLY LEVELS FOR THE KESTERSON NWR

Month	<u>Supply Level 1</u> ac-ft	<u>Supply Level 2</u> ac-ft	<u>Supply Level 3</u> ac-ft	<u>Supply Level 4</u> ac-ft
January	0	0	500	500
February	0	0	500	500
March	0	0	750	750
April	0	0	1,000	1,000
May	0	0	1,000	1,000
June	0	0	600	600
July	0	0	600	600
August	0	0	800	800
September	500	500	1,000	1,000
October	1,500	1,500	1,500	1,500
November	1,500	1,500	1,000	1,000
December	0	0	750	750
Total	3,500	3,500	10,000	10,000

Notes:

Supply Level 1: Existing firm water supply
Supply Level 2: Current average annual water deliveries
Supply Level 3: Full use of existing development
Supply Level 4: Optimum mangement

Source: USFWS, 1986

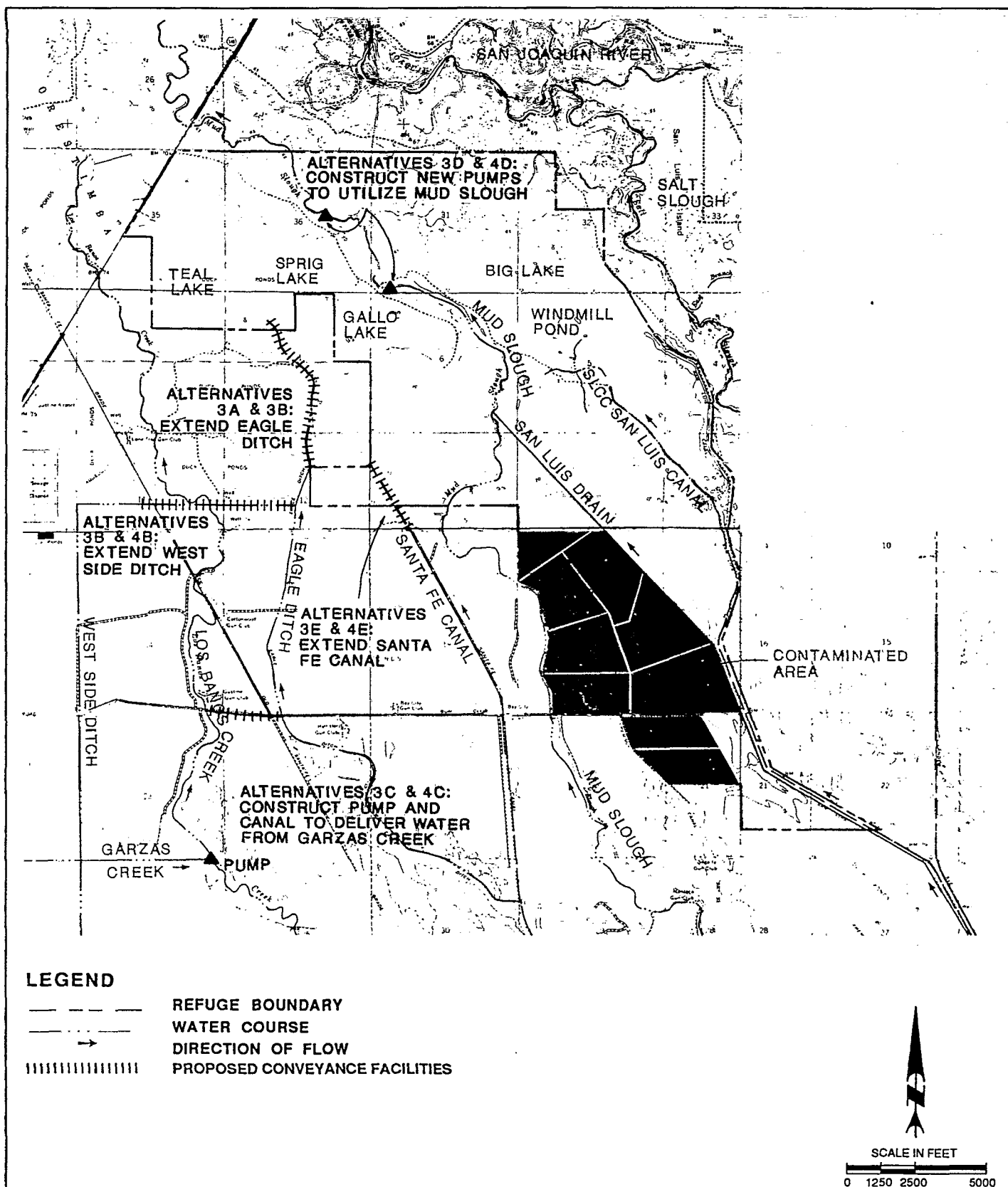


FIGURE IV J-2

KESTERSON NATIONAL WILDLIFE REFUGE

ALTERNATIVE WATER SUPPLY FACILITIES



and Sprig Lakes. This plan would require construction of a 7,600-foot ditch, two 3-way control structures, six crossings, one siphon, and six turnouts.

Alternative 3B - Extend West Side Ditch to Eagle Ditch. The West Side Ditch would be used to convey water from Garzas Creek to Eagle Ditch. A 6,000-foot ditch would be constructed to connect the West Side Ditch and Eagle Ditch. The additional water would be conveyed through Eagle Ditch to Teal and Sprig Lakes. This alternative would require implementation of Alternative 3A.

Alternative 3C - Convey Water from Garzas Creek to Los Banos Creek. Water from the Central California Irrigation District (CCID) Main Canal would be routed from Garzas Creek northward through Los Banos Creek to the Refuge boundary. Ditches and a low-lift pump station would be used to convey water from Garzas Creek to Sprig and Teal Lakes.

Alternative 3D - Utilize Mud Slough. Although the Mud Slough waters are currently contaminated, this conveyance system would be utilized in the future if the quality of the Mud Slough water improves and selenium levels become acceptable for safe fish and wildlife existence. However, two low-lift pumps and a conveyance system would be required.

Alternative 3E - Extend Santa Fe Canal. The GWD Santa Fe Canal would be extended onto the Refuge. Approximately 2,500 feet of existing ditches would be replaced or rehabilitated.

Alternative 3F - Implement a Conjunctive Use Plan. Four wells would be constructed on the Refuge to deliver the maximum month water demand. The exact locations of the wells would be determined in a future study. The wells would be developed as part of a conjunctive use program. During dry years, water demands would be supplied by wells, as discussed in Chapter III. During wet years, the wells would probably not be needed if CVP water is provided. Surface water would be needed during dry years to be used for dilution to reduce salt concentrations in the groundwater supply. Implementation of this alternative also would require implementation of Alternative 2A; Alternatives 3A, 3B, 3C, or 3E; and the Zahm-Sansoni-Nelson Plan.

4. Delivery Alternatives for Level 4 (10,000 acre-feet)

The amount of water to be delivered under Level 4 is equal to the amount of water to be delivered under Level 3. Therefore, the alternatives considered for Level 4 would be the same as for Level 3. All of these alternatives would require implementation of the Zahm-Sansoni-Nelson Plan and Alternative 2A.

Alternative 4A - Extend Eagle Ditch into the Refuge. This alternative is identical to Alternative 3A.

Alternative 4B - Extend West Side Ditch to Eagle Ditch. This alternative is identical to Alternative 3B.

Alternative 4C - Convey Water from Garzas Creek to Los Banos Creek. This alternative is identical to Alternative 3C.

Alternative 4D - Utilize Mud Slough. This alternative is identical to Alternative 3D.

Alternative 4E - Extend Santa Fe Canal. This alternative is identical to Alternative 3E.

Alternative 4F - Implement a Conjunctive Use Plan. This alternative is identical to Alternative 3F.

5. Summary of Alternatives

The beneficial and adverse effects of each alternative were compared with respect to criteria listed in Chapter III.

There were no alternatives considered for Level 1, the No Action Alternative.

Alternative 2A was developed to improve operational efficiency of the GWD Santa Fe Canal and the SLCC San Luis Canal.

Alternatives 3A through 3E and Alternatives 4A through 4E were developed to improve delivery of water to all portions of the Refuge. Alternatives 3A, 3B, 4A, and 4B would require long-term agreements with SLCC. Alternatives 3C and 4C also would require a long-term agreement with CCID. Alternatives 3D and 4D would require removal of contaminants from the Mud Slough. If the contamination is removed, Alternatives 3D and 4D provide the most flexibility to the Refuge because Mud Slough flows through the center of the Refuge.

Alternatives 3F and 4F also would require implementation of surface water alternatives (Alternatives 3A through 3E or Alternatives 4A through 4E) to provide water during wet years. In addition, surface water would be required during dry years to dilute salt concentrations in the groundwater supply.

All of the alternatives would require implementation of the Zahm-Sansoni-Nelson Plan to provide good quality water. Alternative 3B also would require implementation of Alternative 3A.

C. COSTS AND ECONOMIC ANALYSIS

Costs of the alternative plans to provide adequate water supplies under the Water Levels 2,3, and 4 are presented in Table IV J-2. The construction costs include factors to cover engineering, contingencies, and overhead. Annual operation and maintenance (O&M) costs only include the local costs of delivering water. The annual O&M costs do not include costs to purchase CVP

TABLE IV J-2
SUMMARY OF ESTIMATED COSTS OF ALTERNATIVES
KESTERSON NWR

Items	Alternatives						
	2A	3A & 4A	3B & 4B	3C & 4C	3D & 4D	3E & 4E	3F & 4F
Additional Water (ac-ft)	0	6,500	6,500	6,500	6,500	6,500	6,500
Construction Wells							
Wells	\$ --	\$ --	\$ --	\$ --	\$ --	\$ --	\$212,000 ^(k)
Diversion Structures	15,000 ^(a)	15,000 ^(b)	15,000 ^(b)	--	--	--	--
Pipelines/Canals	--	101,000 ^(c)	64,700 ^(e)	15,280 ^(f)	5,000 ^(h)	6,900 ^(j)	--
Pump Stations	--	--	--	120,000 ^(g)	240,000 ⁽ⁱ⁾	--	--
Subtotal	\$ 15,000	\$116,000	\$ 79,700	\$135,280	\$245,000	\$ 6,900	\$212,000
Other Costs	--	15,000 ^(d)	15,000 ^(d)	15,000 ^(d)	15,000 ^(d)	15,000 ^(d)	281,900 ^(l)
Total (m)	\$ 15,000	\$131,000	\$ 94,700	\$150,280	\$260,000	\$ 21,900	\$493,900
Annualized Construction Cost (8.87%, 30 yrs)	\$ 1,450	\$ 12,600	\$ 9,110	\$ 14,460	\$ 25,010	\$ 2,110	\$ 47,510
Additional Annual Cost							
Operation & Maintenance ^(o)	\$ --	\$ 1,750	\$ 1,200	\$ 2,100	\$ 2,400	\$ --	\$ 7,200
Power	--	--	--	6,500 ^(q)	6,500 ^(q)	--	30,100 ^(s, t)
Local Conveyance Cost	--	6,500 ^(p)	6,500 ^(p)	4,880 ^(r)	6,500 ^(p)	6,500 ^(p)	--
Subtotal	\$ --	\$ 8,250	\$ 7,700	\$ 13,480	\$ 15,400	\$ 6,500	\$ 37,300
Other Costs	--	--	--	--	--	--	10,950 ^(l, s)
Total (m,n)	\$ --	\$ 8,250	\$ 7,700	\$ 13,480	\$ 15,400	\$ 6,500	\$ 48,250
Total Annual Costs	\$ 1,450	\$ 20,850	\$ 16,810	\$ 27,940	\$ 40,410	\$ 8,610	\$ 95,760
Cost/Additional Acre-Foot	--	\$ 3.20	\$ 2.60	\$ 4.30	\$ 6.20	\$ 1.30	\$ 14.70

TABLE IV J-2
SUMMARY OF ESTIMATED COSTS OF ALTERNATIVES
KESTERSON NWR
(Continued)

Notes: Alternative 2A - Rehabilitate Santa Fe Canal.
 Alternatives 3A and 4A - Extend Eagle Ditch into the Refuge.
 Alternatives 3B and 4B - Extend West Side Ditch to Eagle Ditch.
 Alternatives 3C and 4C - Convey Water from Garzas Creek to Los Banos Creek.
 Alternatives 3D and 4D - Utilize Mud Slough.
 Alternatives 3E and 4E - Extend Santa Fe Canal.
 Alternatives 3F and 4F - Implement a Conjunctive Use Plan.

- (a) Rehabilitate 2 weirs on the Santa Fe Canal.
- (b) 1 measuring device; two 3-way controls; and 6 turnouts, 25 cfs.
- (c) 7,600 feet of unlined canals; 50 cfs; 6 road crossings, 50 cfs.
- (d) Alternatives 3A through 3F and 4A through 4F would require implementation of Alternative 2A.
- (e) 13,600 feet of unlined canals, 25 cfs; one siphon, 25 cfs; and 6 road crossings, 25 cfs.
- (f) 6,000 feet of unlined canals, 25 cfs.
- (g) 1 pump station, 10-foot lift, 25 cfs.
- (h) 2,000 feet of unlined canal, 25 cfs.
- (i) 2 pump stations, 10-foot lift, 25 cfs.
- (j) 2,500 feet of unlined canal, 25 cfs.
- (k) 4 wells, 500-feet deep, 80-foot lift.
- (l) Alternative 3F assumes implementation of Alternatives 3D and 3E; and Alternative 4F assumes implementation of Alternatives 4D and 4E.
- (m) Total costs do not include cost to implement Zahm-Sansoni-Nelson plan described in Chapter IV G.
- (n) Annual O&M costs do not include cost to deliver Level 1 water supply.
- (o) Basis for O&M costs are discussed in Appendix F.
- (p) Unit Conveyance Cost = \$1/af (GWD).
- (q) Unit Pumping Cost = \$1/af.
- (r) Unit Conveyance Cost = \$0.75/af (CCID)
- (s) Unit Pumping Cost = \$9.25/af.
- (t) Values are multiplied by 0.5 because facilities are assumed to be used only 5 of every 10 years.

water. During the advanced planning phase, these costs will be refined further.

Construction of the facilities under all of the alternatives would result in additional money being spent in Merced County during construction. The construction could be completed within one summer season by construction workers who reside in the area.

Currently, the annual public use to Kesterson NWR averages 2,100 visits per year (Level 2). If additional water is provided, the attendance levels would increase.

D. WILDLIFE RESOURCES

The annual bird use on the Refuge is approximately 3,757,900 use-days. Wildlife and fishery resources associated with the Refuge are presented in Table IV J-3. The listed threatened and endangered species associated with the Refuge are the San Joaquin kit fox, Vulpes macrotis mutica; the bald eagle, Haliaeetus leucocephalus; the American peregrine falcon, Falco peregrinus anatum, and the Aleutian Canada goose, Branta canadensis leucopareia. Numerous candidate species may occur in this area and are also presented in Table IV J-4.

The Refuge may have the highest populations of the endangered San Joaquin kit fox in the GRCD area. It also has the largest associations of native plants of any San Joaquin Valley refuge. A nesting colony of snowy egrets and black crowned night herons use the bulrushes in Sprig Lake, a deep water marsh. The Refuge has one of the best remaining native prairie/vernal pool associations in the area. These vernal pools are the homes of rare plants and are used by waterfowl and resident species.

Implementation of any of the alternatives probably would not adversely affect listed, proposed, and candidate threatened and endangered species. Detailed field investigations will be necessary during the advanced planning phase of the project. Implementation of any of the alternatives would improve habitat, increase bird use, and result in overall beneficial environmental effects, as indicated in Table IV J-5. Additional regional environmental analyses will be completed as part of the Water Contracting EIS's.

E. SOCIAL ANALYSIS

The social consequences of constructing and operating the alternative plans would be positive due to the potential increase in public use.

TABLE IV J-3
WILDLIFE RESOURCES
KESTERSON NWR

Ducks

Mallard(a)	Gadwall(a)	American Wigeon(a)
Green-winged Teal(a)	Blue-winged Teal	Northern Shoveler(a)
Pintail(a)	Bufflehead	Canvasback(a)
Ruddy Duck(a)	Wood Duck	
Redhead(a)	Lesser Scaup	Ring-necked Duck
Cinnamon Teal(a)		

Geese and Swans

Snow Goose	White-fronted Goose	Cackling Canada Goose
Ross' Goose	Canada Goose	Tundra Swan

Coots

American Coot

Shore and Wading Birds

American Avocet(a)	Long-billed Curlew	Snowy Egret(a)
Black-necked Stilt(a)	Killdeer(a)	Black-crowned Night Heron(a)
Common Snipe	Pied-billed Grebe(a)	Lesser Sandhill Crane
Long-billed Dowitcher	California Gull	Greater Sandhill Crane
Least Sandpiper	White Pelican	Virginia Rail(a)
Dunlin	American Bittern(a)	Sora
Western Sandpiper	Great Blue Heron	Common Moorhen(a)
Greater Yellowlegs	Great Egret	
	White-Faced Ibis	

TABLE IV J-3
WILDLIFE RESOURCES
KESTERSON NWR
(Continued)

Upland Game

Mourning Dove^(a)
 Cottontail Rabbit

Ring-necked Pheasant
 Black-tailed Jackrabbit

Raptorial Birds

Turkey Vulture
 Sharp-shinned Hawk
 Swainson's Hawk
 Short-eared Owl
 Golden Eagle

Black-Shouldered Kite^(a)
 Cooper's Hawk
 American Kestrel^(a)
 Great Horned Owl^(a)

Northern Harrier^(a)
 Red-tailed Hawk^(a)
 Barn Owl^(a)
 Burrowing Owl^(a)

Furbearers

Coyote
 Skunk
 Long-Tailed Weasel

Raccoon
 Muskrat

Notes:

(a) Birds nesting on refuge

Source: Birds of San Luis, Merced and Kesterson Wildlife Refuges (RF 11660.3. August 1984),
 NWRs Public Use Report (1) and refuge records.

TABLE IV J-4

FEDERALLY LISTED, PROPOSED, & CANDIDATE THREATENED & ENDANGERED SPECIES
· KESTERSON NWR

Listed Species

Mammals

San Joaquin kit fox, Vulpes macrotis mutica (E)

Birds

Bald eagle, Haliaeetus leucocephalus (E)

American peregrine falcon, Falco peregrine anatum (E)

Aleutian Canada Goose, Branta canadensis leucopareia (E)

Proposed Species

None

Candidate Species

Birds

Swainson's hawk, Buteo swainsoni (2)

White-faced ibis, Plegadis chihi (2)

Western snowy plover, Charadrius alexandrinus nivosus (2)

Tricolored blackbird, Agelaius tricolor (2)

Reptiles

Giant garter snake, Thamnophis couchi gigas (2)

California tiger salamander, Ambystoma tigrinum californiense (2)

Invertebrates

Molestan blister beetle, Lytta molesta (2)

Plants

Hispid bird's-beak, Cordylanthus mollis subsp. hispidus (2)

Delta coyote-thistle, Eryngium racemosum (1)

Bearded allocarya, Plagiobothrys hystriculus (2)

Valley spearscale, Atriplex patula subsp. spicata (2)

Source: USFWS, June 4, 1987

(E)—Endangered

(T)—Threatened

(CH)—Critical Habitat

(1)—Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.

(2)—Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

TABLE IV J-5
WILDLIFE RECREATIONAL BENEFITS AND RESOURCE IMPACTS
KESTERSON NWR

	No Action Alternative	Alternatives						
		2A	3A & 4A	3B & 4B	3C & 4C	3D & 4D	3E & 4E	3F & 4F
Habitat Acres								
Permanent Water	20	20	180	180	180	180	180	180
Seasonal Marsh	470	470	1,240	1,240	1,240	1,240	1,240	1,240
Bird Use Days								
Ducks	2,383,000	2,383,000	4,460,000	4,460,000	4,460,000	4,460,000	4,460,000	4,460,000
Geese	6,900	6,900	13,500	13,500	13,500	13,500	13,500	13,500
Wading and Shorebirds	1,366,000	1,366,000	2,680,000	2,680,000	2,680,000	2,680,000	2,680,000	2,680,000
Endangered Species	2,000	2,000	3,900	3,900	3,900	3,900	3,900	3,900
Total	3,757,900	3,757,900	7,157,400	7,157,400	7,157,400	7,157,400	7,157,400	7,157,400
Public Use Days								
Consumptive	1,800	1,800	1,900	1,900	1,900	1,900	1,900	1,900
Non-Consumptive	300	300	1,600	1,600	1,600	1,600	1,600	1,600
	2,100	2,100	3,500	3,500	3,500	3,500	3,500	3,500
Total Annual Cost	--	\$ 1,450	\$ 20,850	\$ 16,810	\$ 27,940	\$ 40,410	\$ 8,610	\$ 95,760
Incremental Cost/Additional 1000								
Bird Use Days	N/A	N/A	\$ 6.10	\$ 5.00	\$ 8.20	\$ 11.90	\$ 2.50	\$ 28.20
Incremental Cost/Additional								
Public Use Day	N/A	N/A	\$ 14.90	\$ 12.00	\$ 20.00	\$ 28.90	\$ 6.20	\$ 68.40

Notes: Alternative 2A - Rehabilitate Santa Fe Canal.
 Alternatives 3A and 4A - Extend Eagle Ditch into the Refuge.
 Alternatives 3B and 4B - Extend West Side Ditch to Eagle Ditch.
 Alternatives 3C and 4C - Convey Water from Garzas Creek to Los Banos Creek.
 Alternatives 3D and 4D - Utilize Mud Slough.
 Alternatives 3E and 4E - Extend Santa Fe Canal.
 Alternatives 3F and 4F - Implement a Conjunctive Use Plan.

F. POWER ANALYSIS

The Pacific Gas & Electric Company serves the Refuge under the PA-1 rate schedule for agricultural users. A facility must be an authorized function of the CVP to receive project-use power. The authority to deliver CVP project-use power to the Refuge is currently being examined and will be detailed in the Refuge Water Supply Planning Report. A more detailed discussion of project-use power and wheeling agreements is provided in the Power Analysis section of Chapter II.

G. PERMITS

Construction of any of the alternatives would require several permits. Merced County would issue permits for wells and approvals for all construction along roads and drainage courses to ensure that the existing drainage facilities would not be adversely affected. Alternatives 3A, 3B, 3C, and 3E and 4A, 4B, 4C, and 4E would require long-term agreements with SLCC. Alternatives 3C and 4C also would require a long-term agreement with CCID. Stream Alteration Permits would be required from the DFG for Alternatives 3A through 3E and Alternatives 4A through 4E. Approvals from the Regional Water Quality Control Board and other regulatory agencies would be required for Alternatives 3D and 4D to indicate that all contamination was removed from Mud Slough. An Army Corps of Engineers permit would be required for construction activities in wetlands or riparian corridors.